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Specification

1. Title of the Invention
Treated Timber
2. Claims:
(1) Treated timber containing apatite in said timber.
(2) The treated timber according to claim 1, wherein the ratio of apatite to absolute dry weight of timber is 10-100 to 100.
3. Detailed Explanation of the Invention
(Field of the Invention)
The present invention relates to treated timber having low flammability, antiseptic and insect-repellent qualities, and size stability.
(Background of the Invention)
There are a variety of methods for giving low flammability to timber. Those methods are classified into the following groups based on the mechanism.
(a) Covering with inorganic substances;
(b) Acceleration of carbonization;
(c) Inhibition of a chain reaction caused by ignition and burning;
(d) Generation of non-flammable gas;
(e) Endothermic reaction by decomposition and release of water of crystallization; and
(f) Heat insulation by the aerated layer.
It is, however, difficult to make treated timber having sufficiently low flammability by the abovementioned traditional methods.
Since treated timber is used as a building material, it is also important to improve antiseptic and insect-repellent qualities as well as size stability.
(Purpose of the Invention)
Under the circumstances, the present invention intends to provide treated timber having sufficiently low flammability, antiseptic and insect-repellent qualities, and size stability.

(Disclosure of the Invention)

To realize the above-said purpose, the present inventors did research and came up with the idea that we might add apatite to timber. This is because apatite satisfies the mechanism (a) above, and sometimes (b) and (c) depending on its type. We can also expect antiseptic and insect-repellent qualities from apatite in addition to size stability. Since apatite is hardly dissolved in water, there is little possibility of its eluting from timber. The following is more detailed explanation of (a), (b), and (c) mechanisms. In (a), covering with inorganic substances means that even flammable material can become low flammable if it is tightly combined with non-flammable inorganic substances in a proper ratio. The traditional wood cement board is formed by mixing flammable timber with non-flammable cement in the ratio of about 1 to 1 and recognized as semi-non-flammable material by JIS. In (b), acceleration of carbonization is explained as follows: timber cracks by heating and generates flammable gas, which ignites and burns; if phosphate or borate exists, cracking, that it, carbonization of timber is accelerated; and the carbonized layer serves as heat insulation, resulting in low flammability of timber. The mechanism in (c) is as follows: halogen serves as a chain transfer agent in the radical oxidation reaction in the flames; and consequentially, the oxidation reaction is inhibited, resulting in low flammability of timber.

We will explain the present invention in more detail below.

Any type of timber can be used for the present invention including raw lumber, log, sawed lumber, and sliced veneer.

Apatite is a generic name of compounds belonging to a hexagonal space group P63/m whose basic composition is $M_{10}(ZO_4)_6X_2$. In most commonly known apatite, M is Ca and Z is P: for example, apatite hydroxide $Ca_{10}(PO_4)_6(OH)_2$. Apatite according to the present invention, however, includes all the compounds having the abovementioned basic composition. Apatite containing water of crystallization is also included.

There are various ions including 1-3 valence ions in M, 3-7 valence ion in Z, and 0-3 valence ions in X. X could be such a molecule as H_2O. The following are specific examples.

The following is the explanation of antiseptic and insect-repellent effects. In the event that timber is putrefied by fungi, hyphae first infiltrate into the lumen of timber. If there exists a foreign object in the lumen of timber, however, hyphae cannot infiltrate into it, with the result that putrefaction is prevented. It is not necessary for a foreign object in the lumen of timber to be an antiseptic. Anything can work, as far as it is not nutritional to fungi. This is also true for insect-repellent effects. Accordingly, apatite infiltrated into the lumen of timber can improve antiseptic and insect-repellent qualities of timber. The following is the explanation of size stability. If a certain substance can be fixed in the cell walls of timber after the timber is made swollen, the size stability effect can be added because of the bulk effect. The fixed substance could be an inorganic substance that is hardly dissolved in water. In short, size stability can be improved by fixing apatite in the cell walls of timber.

The present inventors had apatite contained in timber. As a result, they came to the conclusion that apatipe could make treated timber have sufficiently low flammability, antiseptic and insect-repellent qualities, and size stability. This is the way they came up with the present invention.

In other words, the present invention relates to treated timber containing apatite inside timber.

M: Ca, Pb, Cd, Sr, Ni, Eu, Al, Y, La, Ce, Na, K, Ba.

Z: P, As, V, Cr, Si, C, Al, S, Re.

X: OH, F, Cl, Br, I, O, N, CO_3, H_2O, □ (vacancy).

It does not mean that any combination of M, Z, and X is possible. The type of combination is limited by, for example, the radii of ions. Two types or more of ions could be contained as M, Z, or X. It is preferable that Z is P, B, or S and X is such halogen as Cl in terms of low flammability.

In light of the use or multiple uses of timber, especially important apatite is as follows: $Ca_{10}(PO_4)_6(OH)_2$, $Ca_{10}(PO_4)_6Cl_2$, $Ca_{10}(PO_4)_6F_2$, $Ca_{10}(PO_4)_6F_xCl_{2-x}$, $Ba_{10}(PO_4)_5(BO_4)\square_2$, $Ca_9Ni(PO_4)_6F_2$, $Ca_8Al_2(PO_4)_5(ALO_4)F_2$, etc.

If we use regular apatite dispersed in water to be filtered into timber, the timber is impregnated with all but only water. This is because the diameter of an apatite particle in the dispersed solution is usually several μ m or more compared with about 0.1 μ m in diameter of the pit membrane space, the narrowest section of the passage through which the dispersed solution pass in timber.

We had timber contain about 0.1 μ m or smaller in diameter of apatite. More specifically, we prepared a dispersed solution by dispersing about 0.1 μ m or smaller in diameter of apatite in water. Desired timber is immersed in said dispersed aqueous solution in order to filter the solution into the timber. Immersing time is not dependent on the type of timber. It could be longer if timber is big or the amount of particles to be filtered into timber tissues is expected to be large. Any method could be used for immersion including, but not limited to, a normal pressure processing method such as a soaking method, warm and cool bathing method, and diffusion method and pressurized processing methods such as a filling cell method, null cell method, and semi-null cell method.

It is preferable that the ratio of apatite to absolute dry timber is 10-100 to 100 in weight. If it is less than 10, the effect tends to be small. If it goes beyond 100, the effect is not in direct proportion to the amount of use, or it tends to become difficult to have the solution filtered into timber.

Since it contains apatite, the treated timber according to the present invention can have sufficiently low flammability, antiseptic and insect-repellent qualities, and size stability.

Refer to the following working examples.

(Working Example 1)

Prepare a dispersed solution by dispersing 0.1 μ m or smaller in diameter of $Ca_{10}(PO_4)_6(OH)_2$ in water. Immerse timber in the dispersed solution. Dry it to make treated timber containing 27 in weight of $Ca_{10}(PO_4)_6(OH)_2$ as compared with 100 in weight of absolute dry timber.

The treated timber had not only sufficient low flammability but also antiseptic and insect-repellent qualities as well as size stability.

(Working Example 2)

Prepare a dispersed solution by dispersing 0.1 μ m or smaller in diameter of $Ca_{10}(PO_4)_6Cl_2$ in water. Immerse timber in the dispersed solution. Dry it to make treated timber containing 42 in weight of $Ca_{10}(PO_4)_6Cl_2$ as compared with 100 in weight of absolute dry timber.

The treated timber was not only sufficiently low flammable but also excellent at size stability (antishrinking efficiency, or ASE, is 37%), not to mention having antiseptic and insect-repellent qualities.

(Working Example 3)

Prepare a dispersed solution by dispersing 0.1 μ m or smaller in diameter of $Ba_{10}(PO_4)_5(BO_4)\square_2$ in water. Immerse timber in the dispersed solution. Dry it to make treated timber containing 11 in weight of $Ba_{10}(PO_4)_5(BO_4)\square_2$ as compared with 100 in weight of absolute dry timber.

The treated timber not only was sufficiently low flammable but also had antiseptic and insect-repellent qualities as well as size stability.

(Effects of the Invention)

Since it contains apatite, the treated timber according to the present invention excels at low flammability, antiseptic and insect-repellent qualities, and size stability.

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